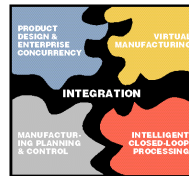


TEAM Enterprise Modeling

James K. Ostic
Johnell M. Gonzales
Patrick T. Reardon
Steven Painter

Los Alamos National Laboratory



Technologies Enabling Agile Manufacturing

Virtual Manufacturing - Enterprise Modeling

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Enterprise Modeling Allows Quantitative Analysis of Manufacturing Agility

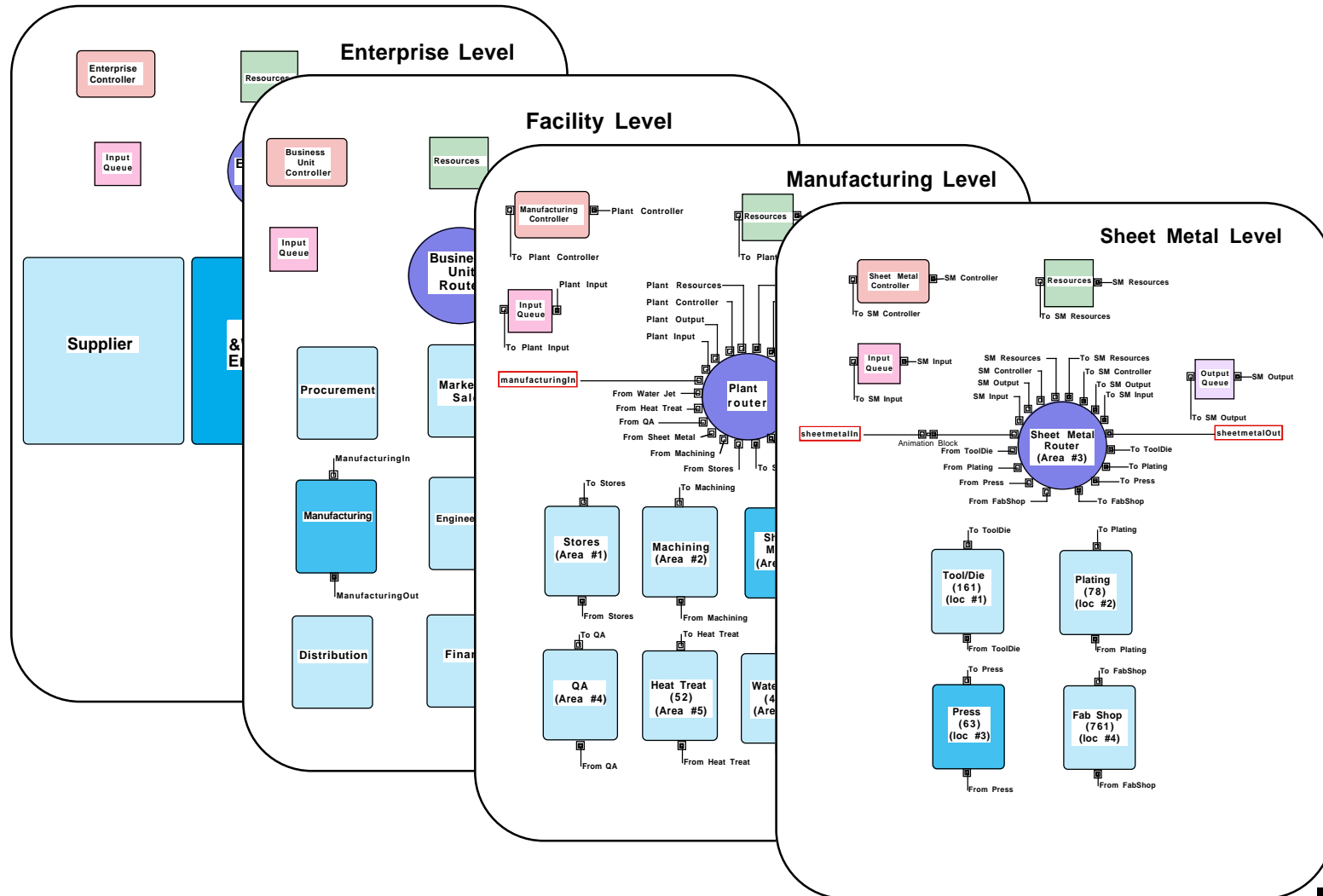
- Identify Agility Metrics for Product
- Benchmark Enterprise Design and Manufacturing
- Perform “What if” Manufacturing Simulations
- Analyze Flex Event Configurations on the Shop Floor
- Enhance Agility in Distributed Virtual Enterprises

Pratt & Whitney F119 Nozzle is the Product Vehicle Used to Demonstrate the Enterprise Modeling Approach



- ◆ Manufactured by Pratt & Whitney Operations - Florida
- ◆ Includes Shop Floor Operations (Machining, Assembly, QA)
- ◆ Sheet Metal TEAM Technology Demonstration is also Included
- ◆ Major Critical Suppliers Contribute ~ 2/3 of Assembled Cost

Enterprise Model Uses Recursive Hierarchical Architecture



. . . Machine Level

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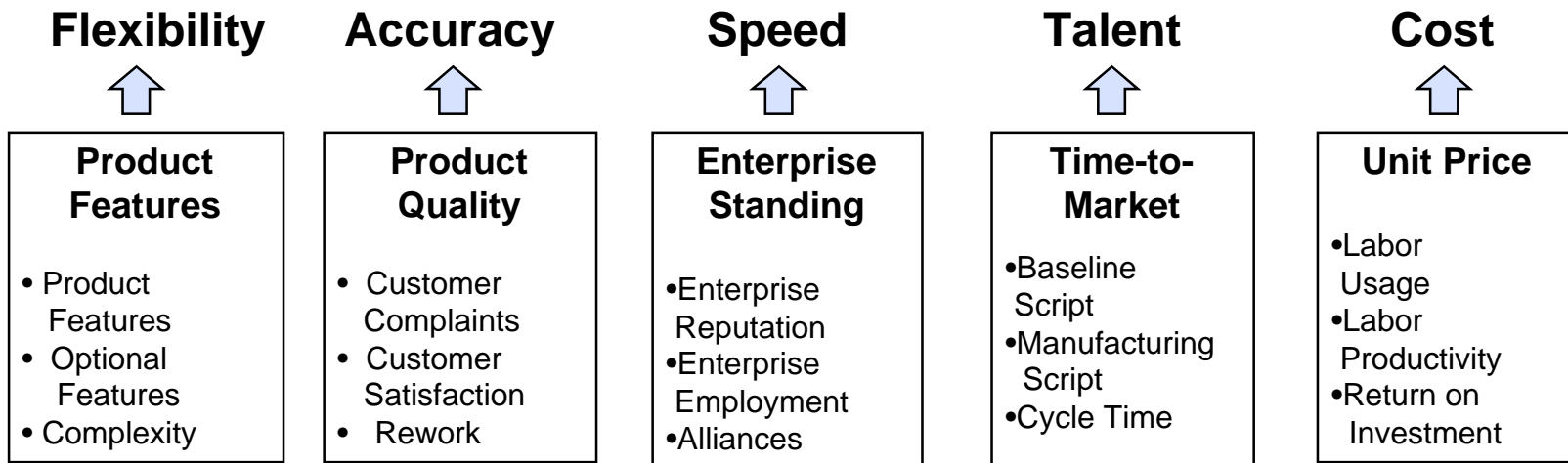


Agility Metrics are Customer Focused

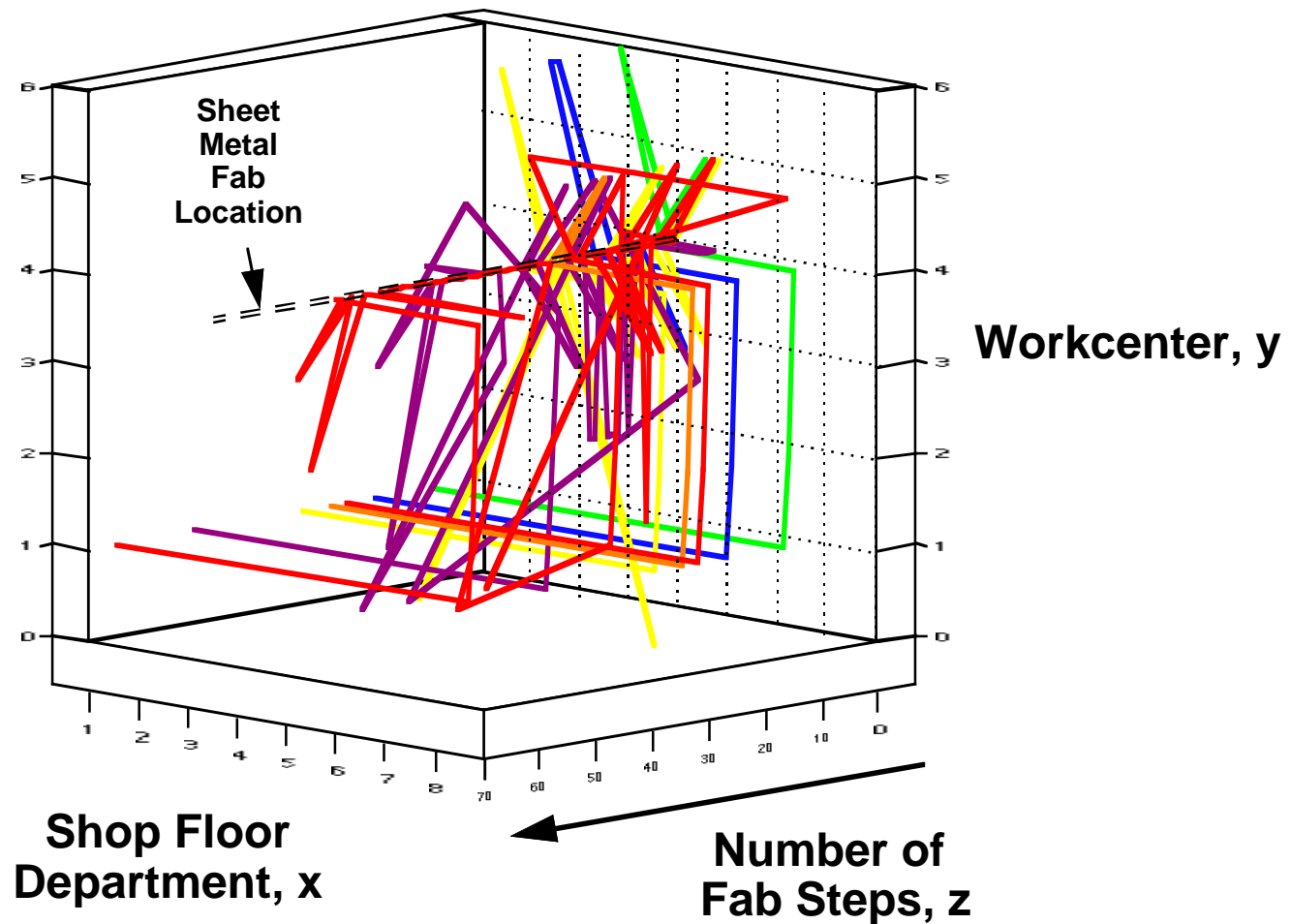
“To deliver the highest value to our customers by maximizing flexibility , accuracy, speed, and talent by minimizing cost.” Bill Eyster, Pratt & Whitney

$$Value \equiv \frac{Max \sum_p (W_f \bullet Flexibility_p \times W_a \bullet Accuracy_p \times W_s \bullet Speed_p \times W_t \bullet Talent_p)}{Min \sum_p Cost_p}$$

Agility Metrics



Sheet Metal Agility is Critical in Nozzle Fabrication Process

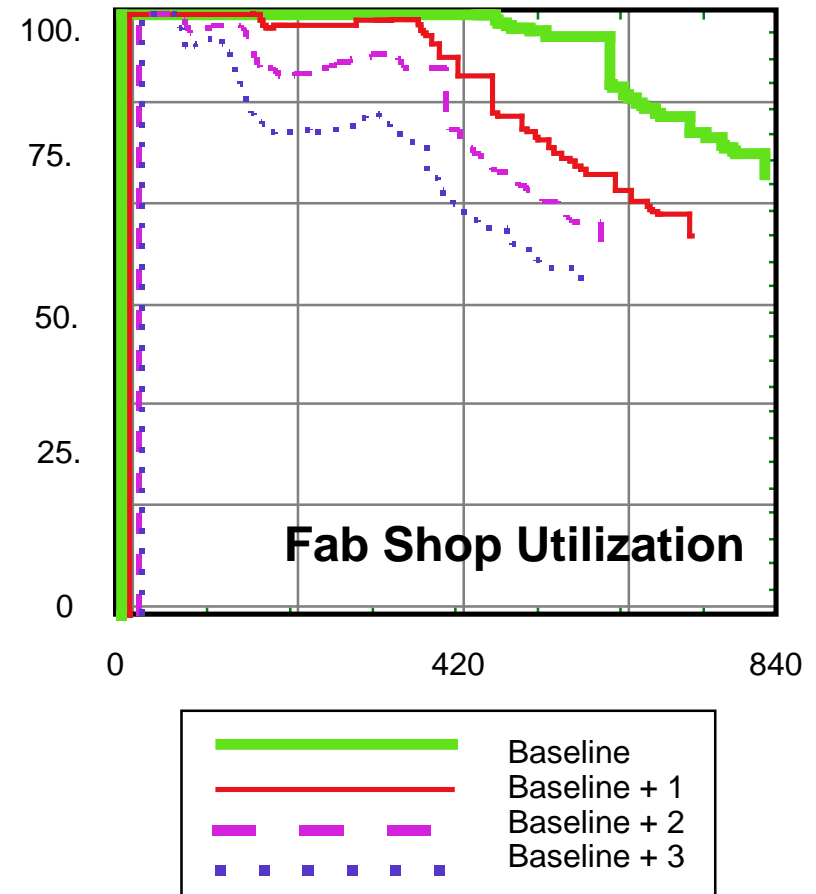
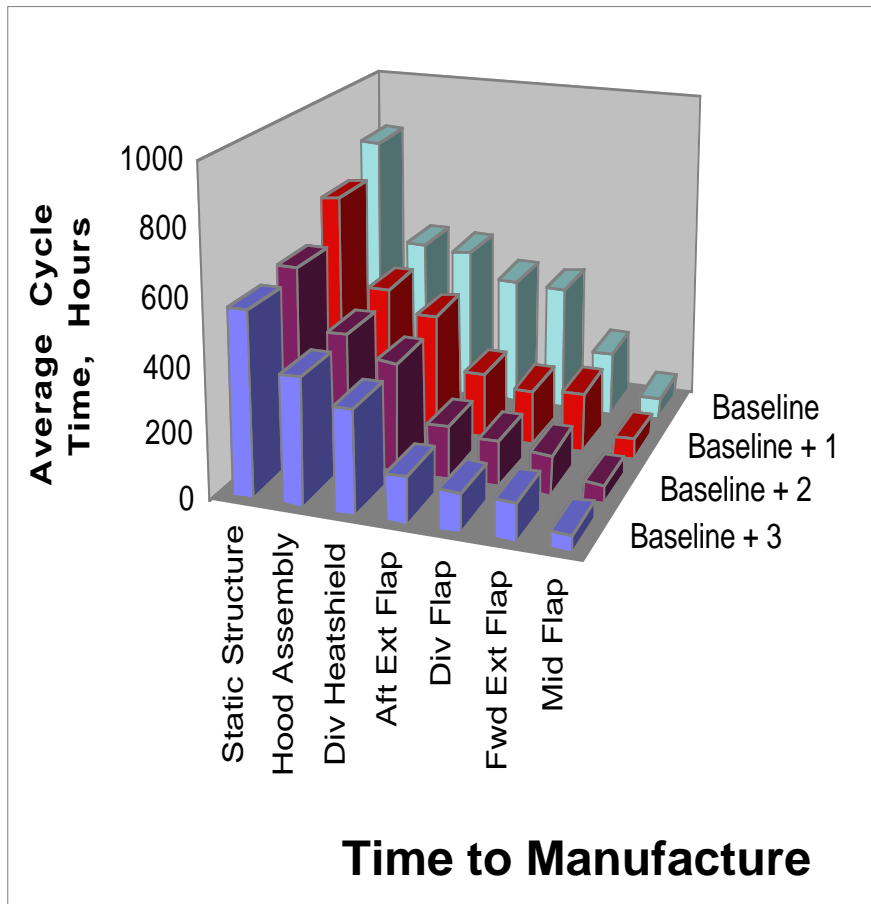


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Significant Improvement Results from Resource Addition at Sheet Metal Fab



Enterprise Modeling Documentation Completed for TEAM

- **Enterprise Simulation Technologies Enabling Agile Manufacturing**
- **ABC: A Generic Cost Methodology for Enterprise Modeling Simulations**
- **The Recursive Executable Cell: A Generic Architecture for EM Simulations using Extend™ - Draft**
- **Enterprise Modeling Requirements for Pratt & Whitney F119 Nozzle - Version 1.0**
- **Simulation Of The Material Removal Demonstration Plan Using Extend™ - Draft**

Future Enterprise Modeling Work for TEAM

- **Complete Model Development**
 - Information Manager for Information Technology
 - Coordinator Logic and Application for REC
 - ABC Implementation
- **Extend Model Functionality to Enterprise Activities**
 - Incorporate Supplier, Engineering, and Support Functions
 - Collect Enterprise and Costing Data
- **Demonstrate Enterprise Model Capability in December 1995**